



## **2014 National Science Bowl®**

### **Middle School Electric Car Competition**

### **Rules**

#### **1. Car Materials:**

- 1-1. Each regional winning academic team must bring a completed and functional car to the National Science Bowl® as part of their team's eligibility.**

**NOTE: A Federal Express shipping label will be emailed so BOTH the completed car and Engineering Design Document can arrive at the 4-H Center by Wednesday, April 23, 2014.**

- 1-2.** A teacher and student car kit will be provided to the winning academic regional teams following the completion of all of the regional academic events.
- 1-3.** Materials from the student kit that must be used include:
- E-flite 3.7V 150 mAh, 25c, Lithium Polymer Battery
  - Mabuchi 280 motor
  - Battery connector: model PKZ3052
  - 2 LED lights
  - Balsa wood from the teacher kit must be used for the chassis
  - On/Off Switch can be used from the teacher kit
- 1-4.** Motors may not be re-wound or disassembled.
- 1-5.** No other batteries or motors may be used in the competition.
- 1-6.** Only one battery and one motor are allowed per car.
- 1-7.** An on/off switch must be incorporated into the car design. The switch may be purchased or crafted from readily available materials such as aluminum foil, paperclips, fasteners, etc. Teams will be allowed to use the on and off switches that were included in the teacher kits.
- 1-8.** Cars will be judged on the use of repurposed and recycled consumer material.
- 1-9.** Cost of car materials will be a judging factor in the design of the car.
- 1-10.** LED lights must be used as headlights at the front of the car or to illuminate logos of event sponsors.

#### **2. Competition Structure**

There are two components to the national competition: a race and a design evaluation.

## **2-1. Race**

Prior to the race, judges will use the Car Inspection Checklist to verify that the car complies with material requirements and is within race specifications (see section 3 below). The race will take place on a 20 meter track and will consist of three time trials. The top 16 teams from the time trials will advance to the modified double elimination. Awards are given to the top three fastest teams in the modified double elimination.

### **Car Race Awards:**

1<sup>st</sup> place in car race: trophy and \$500

2<sup>nd</sup> place in car race: trophy and \$250

3<sup>rd</sup> place in car race: trophy and \$250

## **2-2. Design Evaluation**

The Design Evaluation judging is composed of three separate portions: A) Engineering Design Document, B) Design Interview, and C) Presentation.

### **A. Engineering Design Document**

Each team will complete a written document detailing the engineering design process during the development of the car (see the Engineering Design Document Guidelines). Judging of the Engineering Design Document will take place prior to the competition and will be reviewed by National Science Bowl® technical volunteers. Judges will use the Engineering Design Document Rubric for scoring. Teams may draw the schematics by hand or computer software, but written portions must be typed. The Engineering Design Document is limited to six pages on 8 ½ inch X 11 inch paper. Documents in excess of the six-page limit will not be reviewed by the judges and teams will not receive any points for this portion of the Design Evaluation.

### **B. Design Interview**

After the review and scoring of the Engineering Design Document has been completed, teams will be interviewed by judging teams based on the Design Interview Guidelines. Teams will be asked a series of questions on:

- 1) how the car was engineered based on the materials provided;
- 2) the use of repurposed and recycled consumer materials to reduce costs; and
- 3) the marketability design to make the car a product that the Dabman™ Toy Company will want to include in its toy line.

Judging teams will be evaluating which team should be awarded the production contract from the Dabman™ Toy Company based on the team's ability to use required materials, utilize repurposed and recycled consumer materials, create consumer marketability, develop high performance features, lower production costs and optimize an efficient manufacturing process. The roles of each team member must be described however, one or more students may respond to the interview questions. Judges will use the Design

Interview Rubric for scoring. There are no written documents required for the Design Interview but teams should be prepared to answer questions listed on the Design Interview Rubric.

### C. Presentation

Judges will combine the scores of the **Engineering Design Document** and the **Design Interview** to select the top six teams to complete presentations under the scenario of a commercial advertisement for the Dabman™ Toy Company. Teams need to review the Presentation Guidelines to prepare their 5-minute live sales pitches. No video or pre-produced media will be allowed. A picture of the team's vehicle will be projected behind the team during the presentation. Judges will evaluate each team's ability to market their lithium ion battery powered model car and inspire the next generation of scientists in novel, green technology. The advertisement may be conducted by one or more team members and must be completed within a 5-minute timeframe. Teams exceeding this time limit will have 5 points deducted from their overall presentation scores. Judges will use the Presentation Rubric for scoring. Teams are not required to prepare a formal presentation prior to the Design Evaluation but selected teams should review the Presentation Guidelines and Presentation Rubric to make sure that their presentations address the different components.

The winning team of the Design Evaluation with the highest total score from the following possible points in each portion of the evaluation:

Engineering Design Document	Possible Points = 50
Design Interview	Possible Points = 30
Presentation	Possible Points = 20
<u>Total Possible Points = 100</u>	

### Car Design Awards:

1<sup>st</sup> place car design: trophy and \$500  
2<sup>nd</sup> – 6<sup>th</sup> place car design: \$250

### 3. Race Specifications

- 3-1. The vehicle cannot exceed the following dimensions: 30 cm wide by 60 cm in length.
- 3-2. A decal with a car number and sponsor organizations (provided at the National Science Bowl® competition) must be applied and visible from the side, top or front of the body of the car. A 2.5 x 2.5 cm space must be left for the assigned car number and sponsors.
- 3-3. The vehicle must be designed to carry a payload of 1 full cylindrical salt container: height: 13.5 cm, diameter of 8.3 cm and mass of 737g (+ or – 1%).
- 3-4. The salt container may not be part of the vehicle's structure and must be easily and rapidly removed or reinserted. The following materials are examples of items you can use to hold the salt container on the chassis: rubber bands, string, zip-ties, structured compartment, etc.

- 3-5. Velcro, tape, or any other adhesive cannot be used to secure the container.
- 3-6. The salt container will be supplied at the starting line and must remain unaltered. The salt containers will be reused for each race.
- 3-7. If the salt container falls from the vehicle during the race, this will result in a Did Not Finish (DNF).
- 3-8. Energy Source: New lithium ion batteries will be provided at the National Science Bowl®. Do not bring extra batteries or a battery charger, these will be confiscated.
- 3-9. Steering: A guide wire attachment, referred to as an eyelet, must be attached to the car. This is the only allowable method of steering the car.
- 3-10. A guide wire made of fishing line will be no more than 1.5 cm above the surface of the track. This guide wire will go through the attached eyelet(s) on the car, serving as the steering mechanism, and keeping the car in its lane. Examples of eyelets are shown in Figure 1 below.

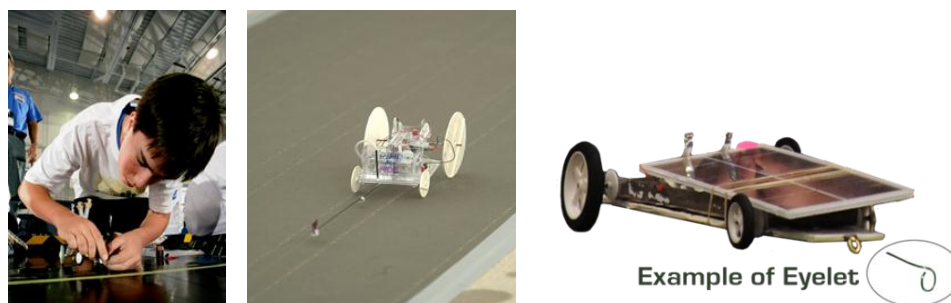


Figure 1: Examples of Eyelet

- 3-11. The vehicle must be easily removed from the guide wire without disconnecting the guide wire.
- 3-12. Lane changing or crossing will result in a DNF.
- 3-13. If a car is interfered with during a race it will be allowed an additional opportunity to run.
- 3-14. Track Dimensions: The track is a black neoprene rubber material. 20 meters long by 60 cm wide on a flat surface.

#### 4. Race Conduct

- 4-1. There will be repair tables in the impound lot to help facilitate quick repairs to the cars. Teams that are scheduled to race in the next heat will be given priority in the repair area.
- 4-2. At race time, the vehicle will be placed behind the starting line and all wheels must be in contact with the ground. No more than two team members will be allowed in the start area.
- 4-3. Teams will have ONE minute to prepare their car at the starting line.
- 4-4. An early start or push start will result in a DNF for that heat.
- 4-5. All vehicles will start when the official signal is given.
- 4-6. An electronic timing system will post the race results. If the timing system is not available, the judges will note the official time on a heat card.
- 4-7. If the car does not finish the race within 40 seconds, it will be noted as a DNF.

- 4-8. At least one team member, but no more than two, must wait at the finish line to catch the vehicle upon completion of the race.
- 4-9. Team members may not accompany or touch the vehicle on the track. Vehicles stalled on the track may be retrieved after the end of the race has been declared by the Lead Judge.
- 4-10. **Students must not walk on the track!**
- 4-11. The vehicle and team member(s) must remain at the finish line until the time of the race has been noted either by the electronic timing system or on the heat card.
- 4-12. Challenges must be made before the race judges begin the next heat.
- 4-13. All challenges must come from the team members who are actively competing, not coaches, parents or coordinators.
- 4-14. All challenges must be directed to the lead judge. Decisions of the race judges are final.
- 4-15. Only competing students and race officials may be in the race area. All others including coaches, parents, mentors, coordinators, and non-competing students must remain in the spectator stands through the duration of the races. Teams will be disqualified if the coach interferes with the race.
- 4-16. Judges may inspect cars at any time before, during or after heats.